BUREAU OF MINES APPROVAL SYSTEM FOR RESPIRATORY PROTECTIVE DEVICES

(REVISION OF I. C. 7600)

BY S. J. PEARCE

* * * * * * * * * **Information Circular 7792**

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director

Work on manuscript completed February 1957. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7792."

June 1957

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Information Circular 7792

Original from THE OHIO STATE UNIVERSITY

SUMMARY AND INTRODUCTION

The Bureau of Mines has prepared, as circumstances have dictated, a series of schedules setting forth the minimum requirements that various types of equipment should meet to be considered safe and satisfactory for use under certain hazardous or unhealthful conditions. These schedules cover a wide variety of devices ranging from explosives to electrically operated mine locomotives. This paper discusses the functions and operations of schedules under which respiratory protective devices are tested and approved. It emphasizes that the aim of the Bureau respirator-approval system is to make available to the public respirators that meet definite performance requirements. The responsibility of the respirator manufacturer in pretesting the device and in maintaining its quality after it is approved are explained. Aid is provided for the user in selecting the proper device for specific application, and a plea is made for better education of all concerned in the proper use of the devices.

DISCUSSION

Provisions have been made for testing and approving the following types of respiratory protective devices: Self-contained breathing apparatus,[2] supplied-air respirators,[3] gas masks,[4] dispersoid respirators,[5] and chemical-cartridge respirators.[6] These devices are tested at the Central Experiment Station of the Bureau of Mines in Pittsburgh, Pa. Self-contained breathing apparatus is tested by personnel of Health and Safety District B; other types of respirators are tested by the Branch of Health Research.

Bureau of Mines approval of a respiratory protective device is based upon performance tests rather than upon specifications as to how the device must be built. For instance, the maximum exhalation resistance of a gas-mask facepiece to an airflow of 3 cubic feet per minute is set at 1.25 inches of water, but there is no requirement as to the size and shape of the exhalation valve or the composition and physical properties of the material from which it is made. This policy allows manufacturers a wide latitude of choice in designing respirators and permits the Bureau to approve radical changes and improvements in the devices without frequent revision of the schedules. Each schedule contains a statement to the effect that (1) the respirator must be constructed, in all of its parts, of materials suitable for the purpose they must serve; and (2) the design, mechanical construction, durability, and workmanship must be satisfactory from the standpoint of safety of the wearer, freedom of movement, field and clearness of vision, fit of the facepiece, and comfort under all conditions of use. This statement gives the Bureau of Mines certain discretionary powers that permit denying approval of a device that may meet the performance requirements of the specific schedule yet may be extremely uncomfortable to wear, flimsily built, or constructed of materials that are not suitable for conditions the device will encounter in service.

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[2] Bureau of Mines, Respiratory Protective Apparatus, Tests for Permissibility, Fees. Part 11. - Self-Contained Breathing Apparatus: Sched. 13D, Sept. 22, 1956, 12 pp. (Code of Federal Regulations reference: 30 CFR, Part 11.)

[3] Bureau of Mines, Respiratory Protective Apparatus, Tests for Permissibility, Fees. Part 12. - Supplied-Air Respirators: Sched. 19B, Apr. 19, 1955, 14 pp. (Code of Federal Regulations reference: 30 CFR, Part 12.)

[4] Bureau of Mines, Respiratory Protective Apparatus, Tests for Permissibility, Fees. Part 13. - Gas Masks: Sched. 14F, Apr. 23, 1955, 9 pp. (Code of Federal Regulations reference: 30 CFR, Part 13.)

[5] Bureau of Mines, Respiratory Protective Apparatus, Tests for Permissibility, Fees. Part 14. - Filter-Type, Dust, Fume, and Mist Respirators: Sched. 21A, Apr. 19, 1955, 7 pp. (Code of Federal Regulations reference: 30 CFR, Part 14.)

[6] Bureau of Mines, Respiratory Protective Apparatus, Tests for Permissibility, Fees. Part 14a. - Nonemergency Gas Respirators (Chemical Cartridge Respirators): Sched. 23A, Apr. 23, 1955, 7 pp. (Code of Federal Regulations reference: 30 CFR, Part 14a.)

The performance requirements for any device are based upon its field of use and upon the three fundamental requirements for a satisfactory device: (1) It must provide adequate protection for a suitable period, (2) it must be reasonably comfortable and convenient to wear, and (3) it must be constructed of durable materials. The desirable characteristics of the device are considered from the idealistic and practical standpoints, tentative requirements are set up, test apparatus and procedures are devised, and tests are made on the devices available. On the basis of these tests, such modifications of the requirements are made as seem desirable. An effort is made to anticipate possible future development and modification of the device and its field of use, and to make the schedule flexible enough to be applicable over as wide a range of design as possible. A tentative draft of the proposed schedule is sent for comment and criticism to well-qualified industrial hygienists and safety engineers, as well as to manufacturers and users of the device. Comments and criticisms are weighed, and acceptable changes are made accordingly in the proposed schedule. All the suggested changes may not be incorporated in the schedule; the reasons why they have not been used are stated to those who proposed the changes, and further argument for the changes is invited. The proposed schedule in its revised form is published in the Federal Register as a Notice of Proposed Rule Making, with a statement that those interested may present written data, views, or arguments concerning it to the Director of the Bureau of Mines. All relevant material, received not later than 30 days after publication of the proposed schedule, is considered before the final draft of the schedule is prepared. The final schedule is submitted to the Secretary of the Interior for approval and, if approved, becomes effective on the date on which it is published in the Federal Register. Once a schedule has been published, all those concerned must abide by its provisions until it has been officially revised - if the desirability of such action has been indicated. The Bureau of Mines may test and approve only those devices that are covered by existing Bureau of Mines schedules. When devices not covered by existing schedules are developed and have come into use and if they are deemed worthy of Bureau of Mines approval, existing schedules are revised or new schedules are prepared to cover them. For instance, air-line respirators and abrasive-blasting respirators were covered by revising and broadening the scope of Schedule 19, which previously applied only to hose masks; nonemergency gas respirators or chemical-cartridge respirators required an entirely new schedule, and work is progressing on the development of performance requirements for paint-spray respirators.

Submitting respiratory protective devices to the Bureau of Mines for approval is entirely voluntary on the part of the manufacturer. The Bureau has no regulatory power requiring that all respirators must be submitted for approval testing. It acts merely as an impartial testing agency that serves by making available to the public a list of respiratory protective devices that have met definite performance requirements. The wide acceptance of Bureau of Mines approval of these devices encourages manufacturers to submit them for approval.

A manufacturer may visit or communicate with the Bureau of Mines at Pittsburgh to obtain criticism of proposed designs of respirators or to discuss test requirements in connection with a device to be submitted. No fee is charged for a consultation, and no written report is made to the manufacturer.

There are certain requirements that must be fulfilled before the Bureau of Mines will undertake the active investigation of a respirator. The manufacturer must file an application that contains (1) a description and complete drawing of the device, (2) a statement that the device is completely developed from the design and materials believed suitable for a finished marketable product, (3) a statement that the device has been tested according to and has met the schedule requirements, (4) a statement regarding the nature, adequacy, and continuity of controlling the quality of the device, and (5) a request that the necessary inspections and tests leading to approval be made. If the application is acceptable, the manufacturer is notified of the number of complete respirators and replaceable parts that the Bureau of Mines will need for tests and the testing fee required.

The fee ranges from $160 for approval testing of a dust respirator for protection against pneumoconiosis-producing dusts to $1,500 for approval testing of a 2-hour self-contained breathing apparatus. If the device is approved, the fee is sent to the Treasury of the United States to the credit of miscellaneous receipts. If the device fails to pass the specified tests, enough of the fee is sent to the Treasury to cover the work done by the Bureau of Mines, and the balance is returned to the manufacturer.

When the material, fees, and manufacturer's test data have been received, the Bureau begins testing the device according to the requirements of the pertinent schedule. The tests may be witnessed by a representative of the manufacturer, with the understanding that the results are to be kept confidential. The Bureau test data are compared with the manufacturer's test data. If serious discrepancies are noted, both parties rerun the tests and recheck their data, and the cause for the discrepancy is determined and remedied. Comparing test data is important, as from it the Bureau can check the manufacturer's quality-control procedure.

If the device meets the schedule requirements, the manufacturer is notified formally that the device has been approved, and he is furnished with official Bureau of Mines approval plates. If, however, the device fails to meet the schedule requirements, the Bureau attempts to determine the cause of failure and suggests to the manufacturer how the difficulty might be overcome. This is in keeping with the policy that the Bureau of Mines approval system for respiratory protective devices exists mainly to promote the development and manufacture of devices of known good quality and not for the purpose of stifling or inhibiting such development. After the manufacturer has made suitable changes in the device and has satisfied himself by tests that it now is ready for further approval testing, he resubmits it to the Bureau with the fee required for the additional tests.

The Bureau of Mines approval applies only to the respirator as a unit and not to its integral parts. For instance, if approvals were granted to four respirator manufacturers, A, B, C, and D, on four entirely different universal-type gas masks, an assembly of A's canister harness, B's canister, C's timer, and D's facepiece would not constitute an approved assembly, even though the individual items were parts of approved gas masks. The approval of a complete device applies throughout the entire Bureau of Mines approval system and is not peculiar to those schedules that deal with respiratory protective equipment.

The respirator-approval labels prepared by the Bureau and issued to the manufacturer must appear on the containers for the approved devices. In addition, special approval labels must appear on the individual canisters or cartridges and on the containers for extra filters for dust respirators. Approval markings also are required on certain parts of approved devices, such as on the canister harness, canister, timer, and facepiece of the universal-type gas masks; and on the facepiece and filter of a dust respirator.

The approval label on a respirator gives much more information than just the fact that the device has been approved by the Bureau of Mines: (1) It gives the limitations of the approval, such as the type and maximum concentration of gas in which a gas mask may be worn; it may bear a statement, such as that on the approval label of a type C supplied-air respirator - "Approved for respiratory protection in any atmosphere not immediately harmful or from which the wearer can escape unharmed without the aid of the respirator"; (2) it lists the approval markings on the parts that make up the approved assembly; and (3) it lists special precautions that should be taken when using the device. The approval label should be studied carefully, so that the device is used in an approved manner. It should be pointed out that, even though a respirator has numerous Bureau of Mines approval markings, if it is used improperly or under conditions other than those covered by the approval label, the approval of that individual respirator is invalidated.

In preparing schedule test requirements an endeavor has been made to provide for safe, durable, and practical devices that will meet not only the demands of existing situations but also the demands of potential and anticipated situations for which the respirators are designed. However, with continued adaptation of these devices to new situations and conditions, instances might arise where the protection afforded would be inadequate. The Bureau of Mines, with the cooperation of both the manufacturers and the users of respirators, endeavors to be alert to these new situations. If a situation arises in which the wearer is inadequately protected or an unusual hazard attends the use of an approved device, the manufacturer (or manufacturers) of the device is requested to affix caution statements or, if necessary, to cease marketing the device for the particular situation or condition until changes or provisions for adequate protection are made, and any provisions or changes made must be submitted to the Bureau of Mines for approval before being adopted. Should the situation require a change in basic requirements or tests provided by the schedule in question, such changes will be issued as a revision of the current schedule.

An illustration follows: It has been customary in the past to refer to respirators that have been tested by the Bureau of Mines against lead dust as "toxic dust" respirators, those tested against both silica dust and lead dust as "all-dust" respirators, and those tested against lead fumes as "fume" respirators, with no limitation as to the dusts and fumes covered by the approval. In the past few years several highly toxic dusts and fumes have entered the industrial picture; namely, beryllium dusts and fumes, dusts impregnated with organic phosphorous compounds (such as some recently developed insecticides), and radioactive dusts. In the interest of safety the Bureau of Mines decided to limit the approval of toxic-dust, dust, and fume respirators to dusts and fumes that are not significantly more toxic than lead. Hence, the approval plates on all such respirators were revised to include the statement, "that are not significantly more toxic than lead."

Another illustration is the Bureau's decision not to approve mechanical-filter-type respirators for respiratory protection against lead-paint mist, even though provision was made for such approval in Schedule 21. On the basis of answers received in response to a questionnaire, the Bureau has decided that approval will be granted for respiratory protection against paint sprays only to devices that are capable of removing organic vapors as well as solid particulates and mists from the air drawn to the respirator. This necessitates the preparation of new performance requirements for such respirators.

The Bureau of Mines approval label on a respirator is an indication that it has met certain performance requirements. Approval schedules are available to the user if he wishes to check on these requirements. The Bureau does not, and cannot, make any statement as to how much a device exceeds these requirements nor does it recommend the use of any specific approved respirator. Any claim to superiority of a respirator must come from the manufacturer and should be based upon his own test data rather than on test data that he may have observed when witnessing approval tests in the Bureau laboratories.

Bureau of Mines approval is issued with the understanding that the manufacturer will make the respirator according to the drawings, design, and model that he has submitted to the Bureau and that have been considered and included in the approval. If he desires to make any change in the design of a permissible respirator he must first obtain Bureau approval of the change.

From time to time the Bureau of Mines purchases and tests approved respirators that are on the market to ascertain whether or not they conform to the approved device in physical makeup and performance. If on the basis of such testing it is found that the device differs from that approved either in design or performance, the manufacturer is notified to take immediate steps to correct the situation. If the performance of the device is faulty, it may be necessary for the Bureau to inform the manufacturer to cease marketing the device until the Bureau ascertains that its performance has been brought up to standard and will be maintained at that standard. The Bureau cooperates in every way with the manufacturer to discover the cause of inadequacy, to help correct it, and to retest the respirator as promptly as possible so that production may be resumed. Laxity in control and inspection has been the main cause rather than intentional cheapening of the product. The Bureau of Mines has authority to rescind an approval but has not yet been forced to take drastic action.

A further and important function of personnel engaged in approval testing of respiratory protective devices is to disseminate information on respirators - approved respirators in particular. This is done by informal talks and papers presented before various groups, and by publications, approval lists, personal contact, committee membership, and correspondence. The request received most frequently is for information on selecting respirators for specific application. Figure 1 should aid a prospective user in making his own selection.

The manufacturers of respiratory protective devices, in cooperation with the Bureau of Mines, have made available a wide selection of approved respirators to meet virtually any situation in which such protection is needed. This is only half the job. There remains for all concerned the important task of educating people in industry - management as well as persons who actually will wear the respirators - on the proper selection, use, and maintenance of these devices. It is hoped that this paper will be a step toward this end by promoting a better understanding of the Bureau of Mines system of approval for respiratory protective devices.

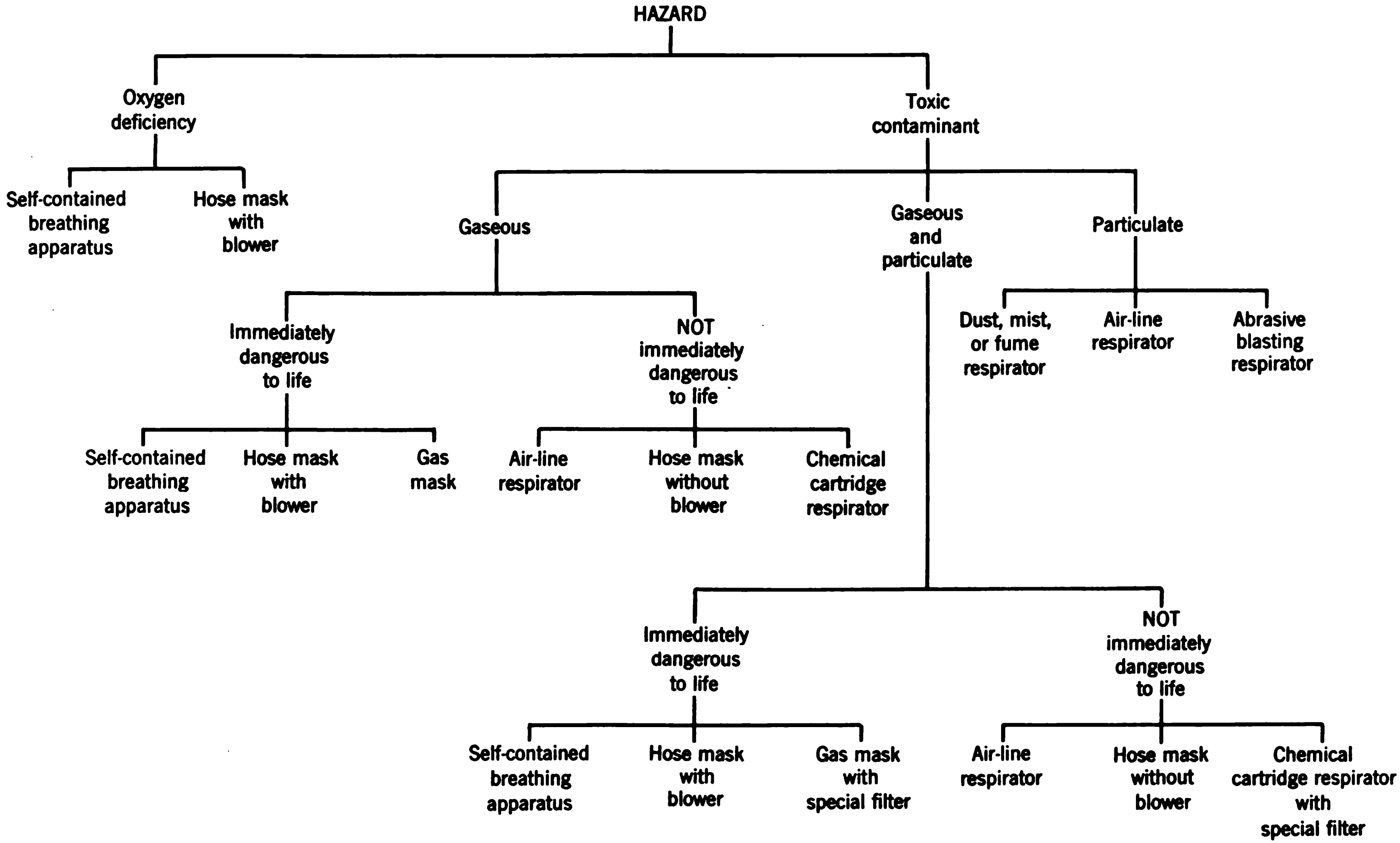
HAZARD
Oxygen deficiency
Toxic contaminant
Self-contained breathing apparatus
Hose mask with blower
Gaseous
Gaseous and particulate
Particulate
Immediately dangerous to life
NOT immediately dangerous to life
Dust, mist, or fume respirator
Air-line respirator
Abrasive blasting respirator
Self-contained breathing apparatus
Hose mask with blower
Gas mask
Air-line respirator
Hose mask without blower
Chemical cartridge respirator
Immediately dangerous to life
NOT immediately dangerous to life
Self-contained breathing apparatus
Hose mask with blower
Gas mask with special filter
Air-line respirator
Hose mask without blower
Chemical cartridge respirator with special filter

Figure 1. - Outline for selecting respiratory protective devices.

INT.-BU.OF MINES,PGH.,PA. 8448